AEGIS Environmental Assessment Tool

TEP Status Update
NOWCAST IPT June 25, 2002
Monterrey CA

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LOCKHEED MARTIN

Ship Self Defense – the Problem of the Day

- **The ASCM threat continues to evolve**
- **The operating environment can change Firm Track Range -- as much as 100%**
- **Littoral Operations complicate Firm Track Prediction**
- **Decisions are being made without understanding the environmental impact**

Documented Aegis requirements for METOC support:

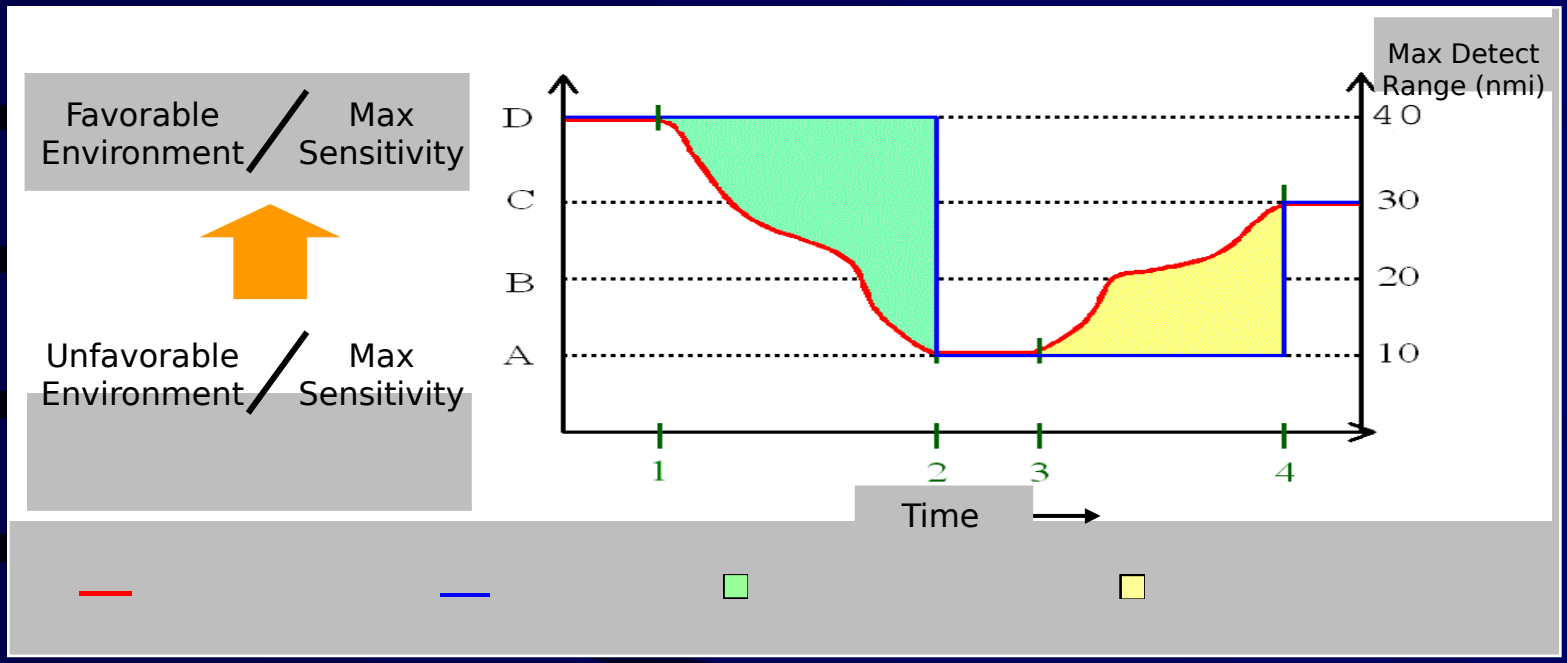
- **AEGIS Combat System Environmental Studies Report dtd 31 Dec 96 by Lockheed Martin**
- **Aegis Environmental Data Requirements dtd 14 Jul 94 by JHU-APL**

Exploiting the Environment to Win
… from Sensor to Shooter

**"Knowing the Weather is Nice.
Knowing What the Weather Does
-To You and Your Enemy-
Is What Matters."**

**LT Don Gabrielson
XO, USS ANZIO**

Optimizing Sensors in a Rapidly Changing Environment

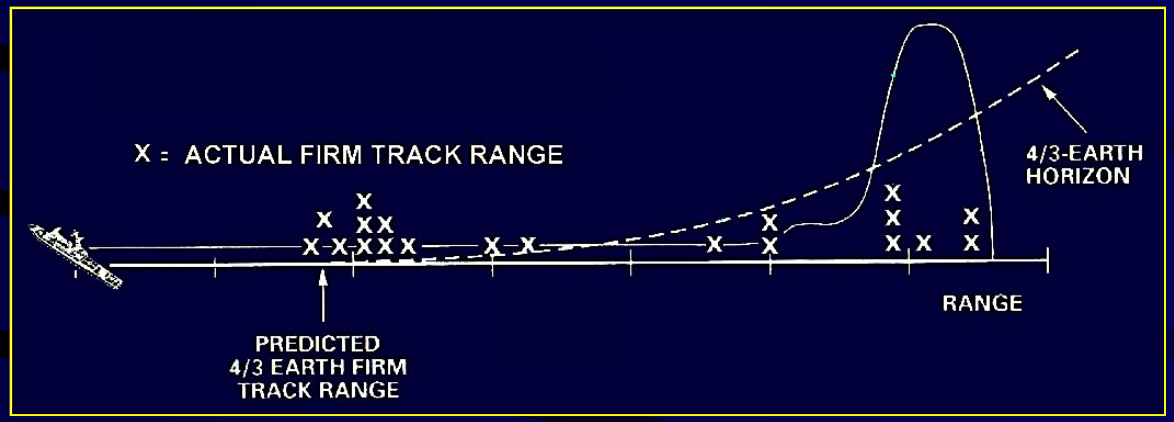


Excerpt from: "EXPLOITING THE ENVIRONMENT TO WIN IN THE 21ST CENTURY", by CAPT R. Easton, USS PORT ROYAL, and LT E. Sanabia, Operations Officer, NPMOC

The challenge facing the radar operator is to keep up with the changing environment.

Effects of Environment on the Engagement Loop

20 post-exercise analyses of littoral environments based on timely Helo and/or Rocketsonde measurements



The operating environment can change Firm Track Range -- as much as 100%

AEGIS performance can vary drastically with the environment… but Post-Mission analysis shows performance is predictable with adequate environmental measurements

AEGIS Environmental Assessment Concept

- Real-Time "Through the Sensor" Measurements
- Onboard Tactical Decision Aids for SPY-1 Radar Operator
- Live MET Feed for CVBG Environmental Situational Awareness

AN/SPY-1

Radar Data and Doctrine via Passive Data Tap

Adjunct Signal Processor

IT21

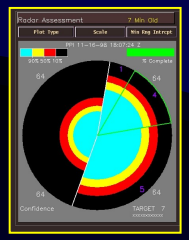
TEDS/NITES (CVBG, ARG)

NOWCAST

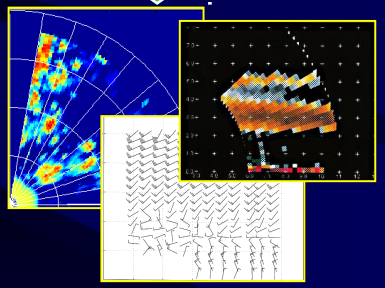
Data Distribution to

CVBG or ARG (raw and derived products)

Moriah

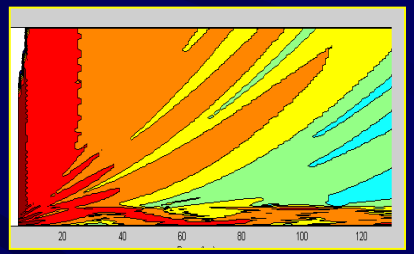


SEAWASP Radar Assessment TDA (JHU/APL)



TEP Data Products

- **Reflectivity, Radial Vel.**
- **3D Winds Aloft**
- **Cloud Base/Tops**



RFC Function (SPAWAR)

- **3D Propagation and Ducting**

TJM 062502- 6

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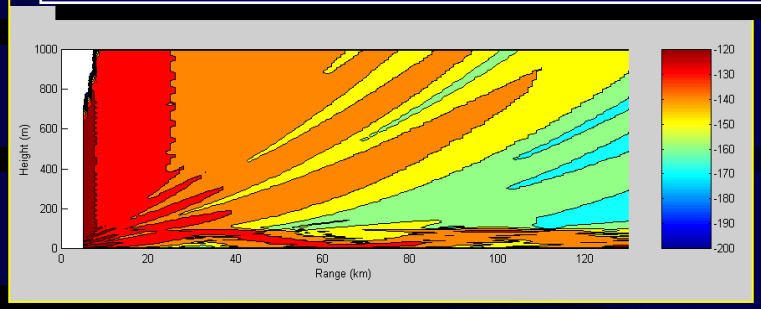
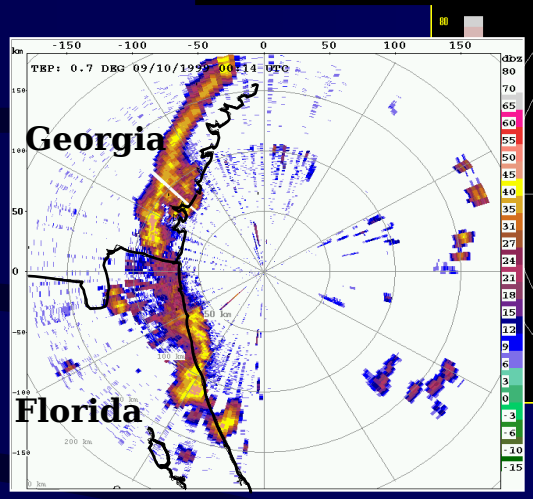
SPY-1/TEP Aboard USS O'KANE

Refractivity From Clutter (SPAWAR)

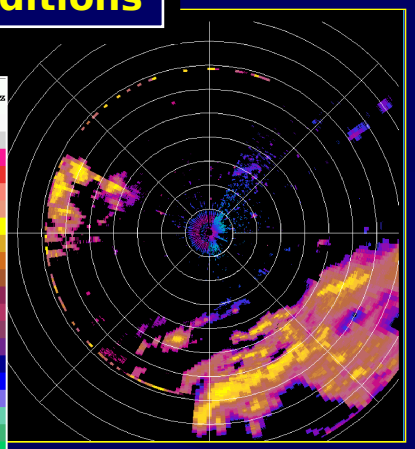


Offshore Wallops Island, August 28, 1999

Hazardous Conditions

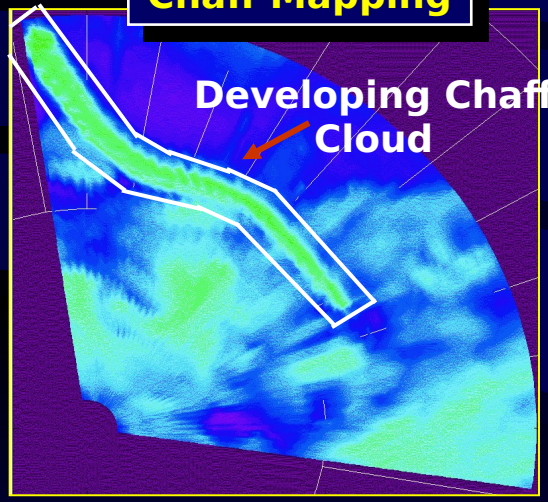


Nighttime Squall off JAX Sept 10, 1999



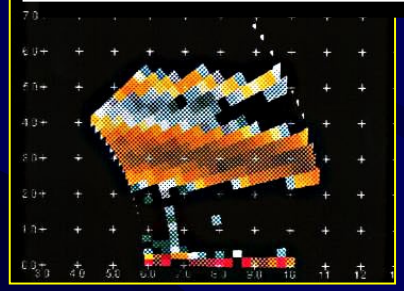
Hurricane Dennis August 30,

Chaff Mapping



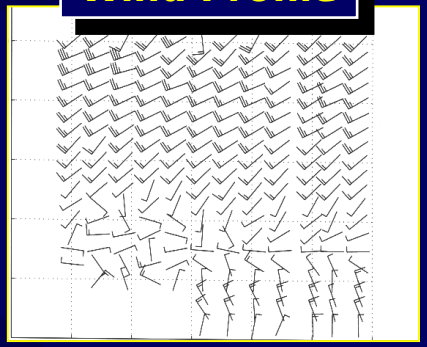
Air Dropped Chaff, Hawaii OPAREA Dec 12, 1999

Cloud Base/Tops



Cloud Tops/Bases Mar 18, 1997

Wind Profile



Winds off JAX Sept 10, 1999

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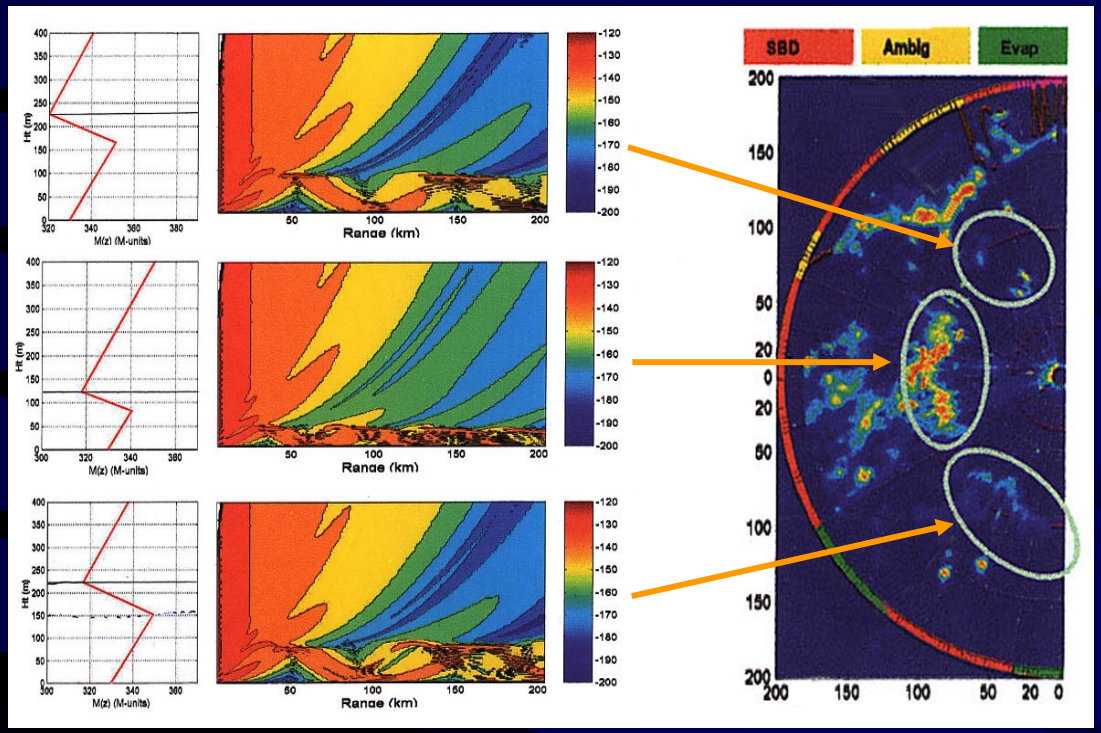
Real-Time Volumetric Ducting

TEP/RFC Refractivity Report



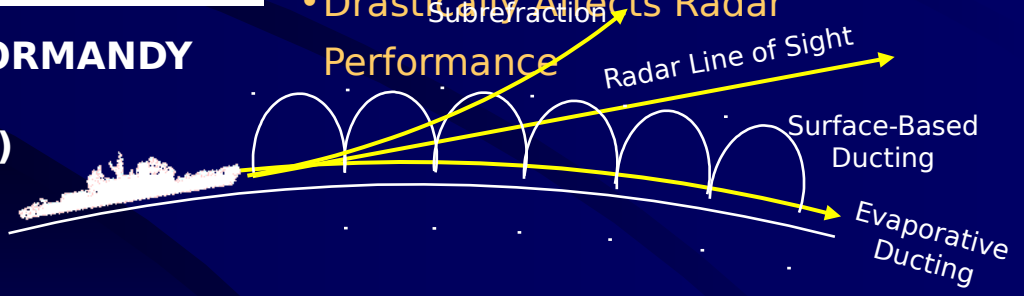
RFC Report from TEP aboard USS NORMANDY
May 13 2000 off VACAPES
(Plots Courtesy of SPAWAR)

Standard Atmosphere is NOT the Norm

- Evap Duct 25% of Time in Persian Gulf
- Surface Duct 80% of Time in Gulf in Summer
- Surface Duct Over 100 Nm in Certain Regions

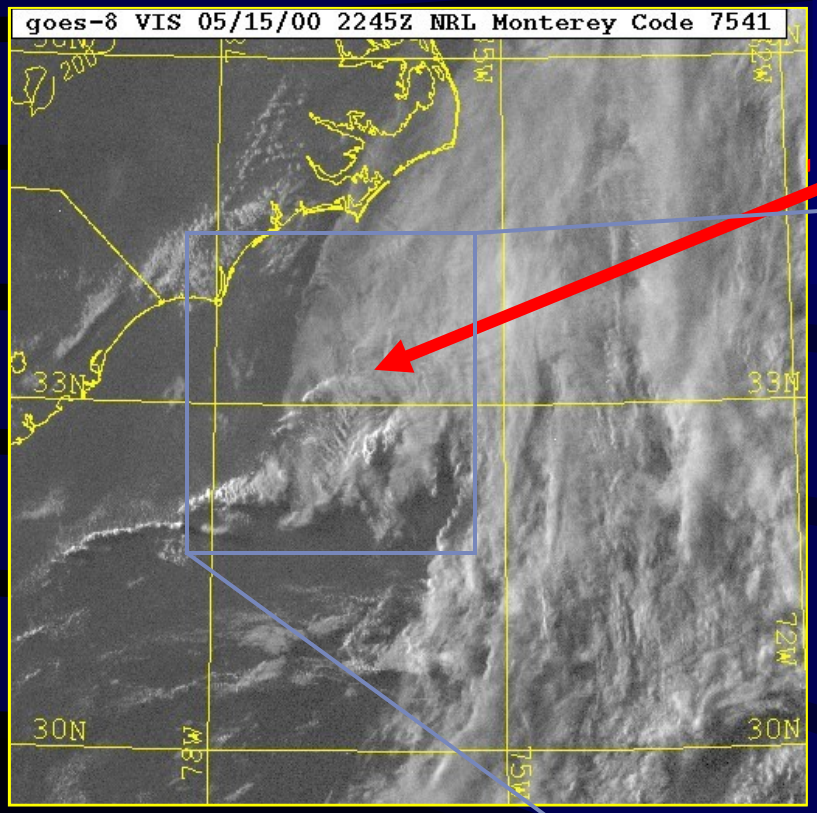
Refractivity Changes Rapidly over Space and Time

- Non-Homogeneous
- Can Change Significantly in 30 min or less
- Drastically Affects Radar Performance



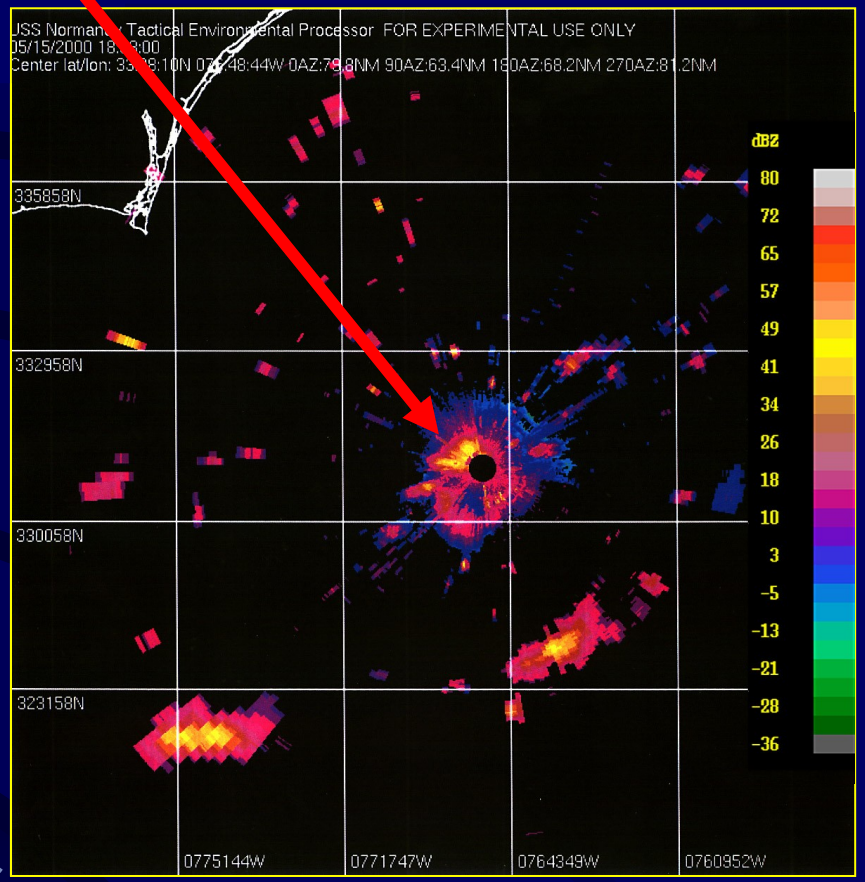
Safety of Flight

JTFEX, 15 May 2000 aboard USS NORMANDY



GOES-8 Visual

At 1858 a Squall line with 50kt dow
disrupted Air Ops aboard USS GW
atellite by High-Level Cirrus



TEP Reflectivity

Managing Doctrine for Tactical Advantage

"When Should I See the Threat?"

"Where Can't I See It?"

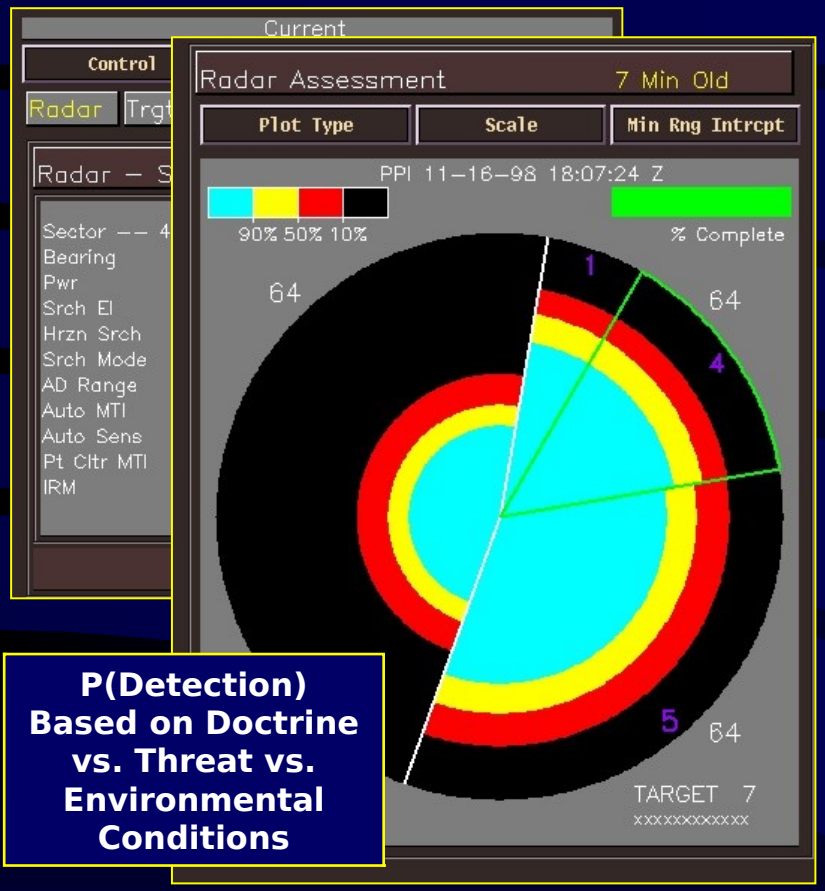
"What if I add or lose a platform?"

"Am I In The Best Location to do my job?"

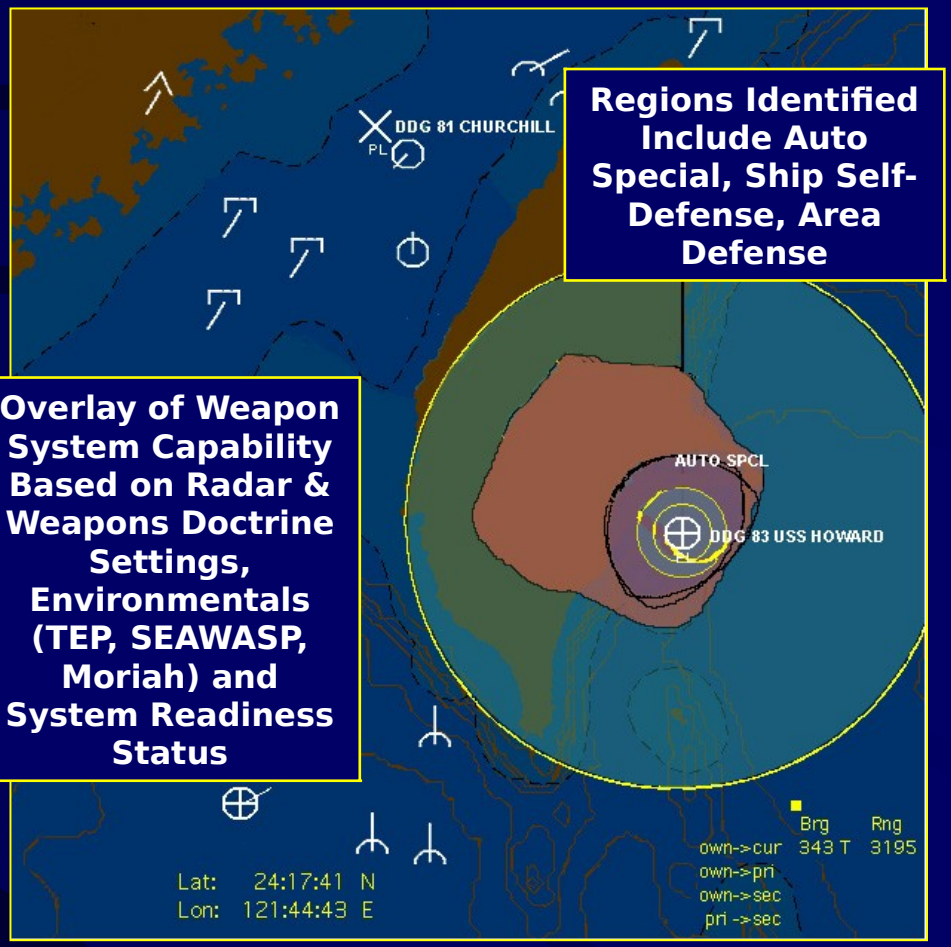
Give Commanders:
- **Data to Improve Coverage**
- **More Time to Make Decisions**

"We Need a Tool That Lets Operators Compare Options and Make Informed Decisions in this Game of Competing Alternatives"

Weapons Performance TDA Evolution



P(Detection) Based on Doctrine vs. Threat vs. Environmental Conditions



Regions Identified Include Auto Special, Ship Self-Defense, Area Defense

Overlay of Weapon System Capability Based on Radar & Weapons Doctrine Settings, Environmentals (TEP, SEAWASP, Moriah) and System Readiness Status

SEAWASP → Doctrine Planning & Assessment

TJM 062502- 11

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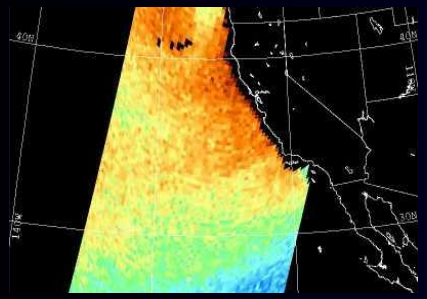
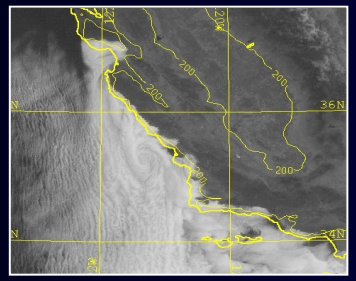
Environmental Situational Awareness

Nowcast utilizes a complementary suite of sensing systems to maximize the usefulness of TEP data to the Battlegroup

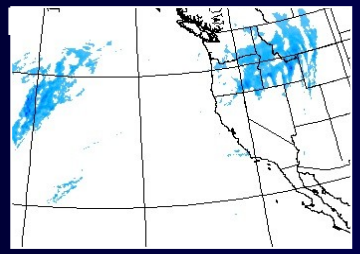
Satellite



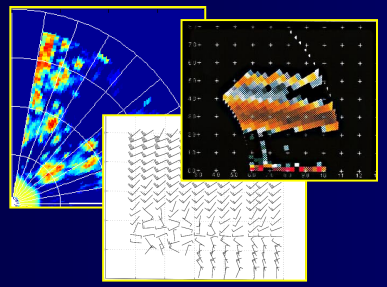
Cloud Imagery



Satellite Rain



TEP

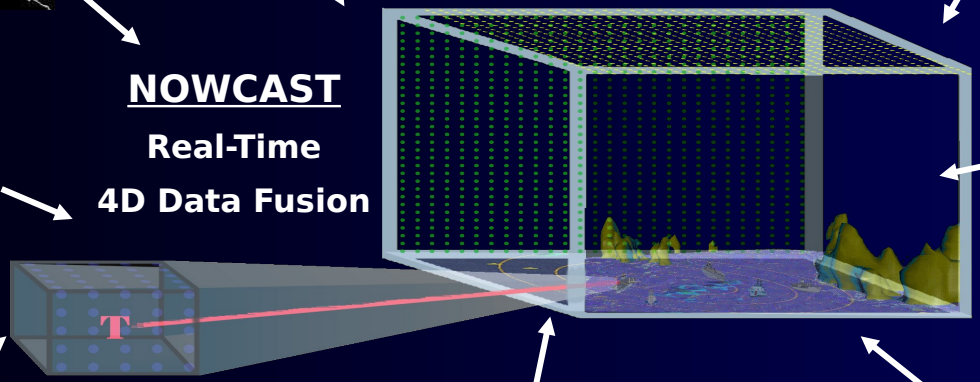


UAV Weather

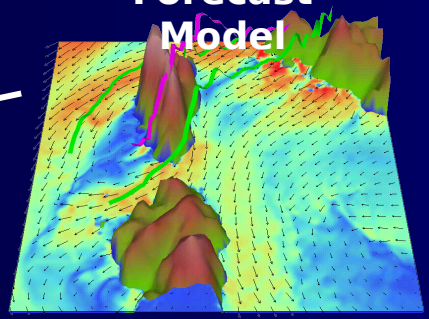
NOWCAST

Real-Time

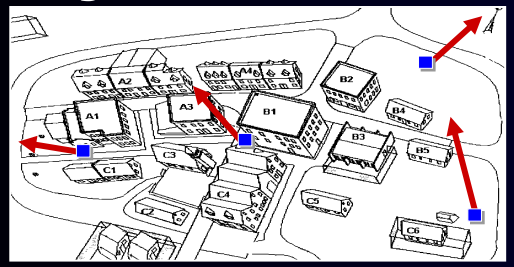
4D Data Fusion



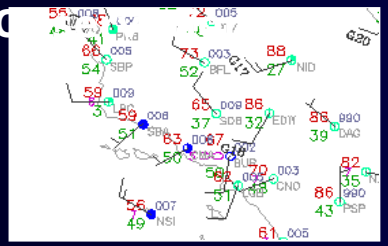
Weather Forecast Model



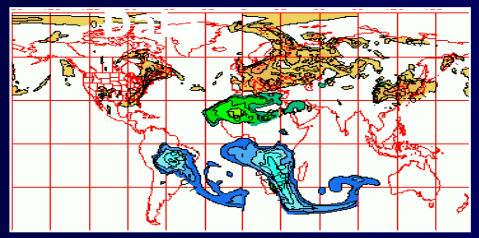
Target Area Weather Data



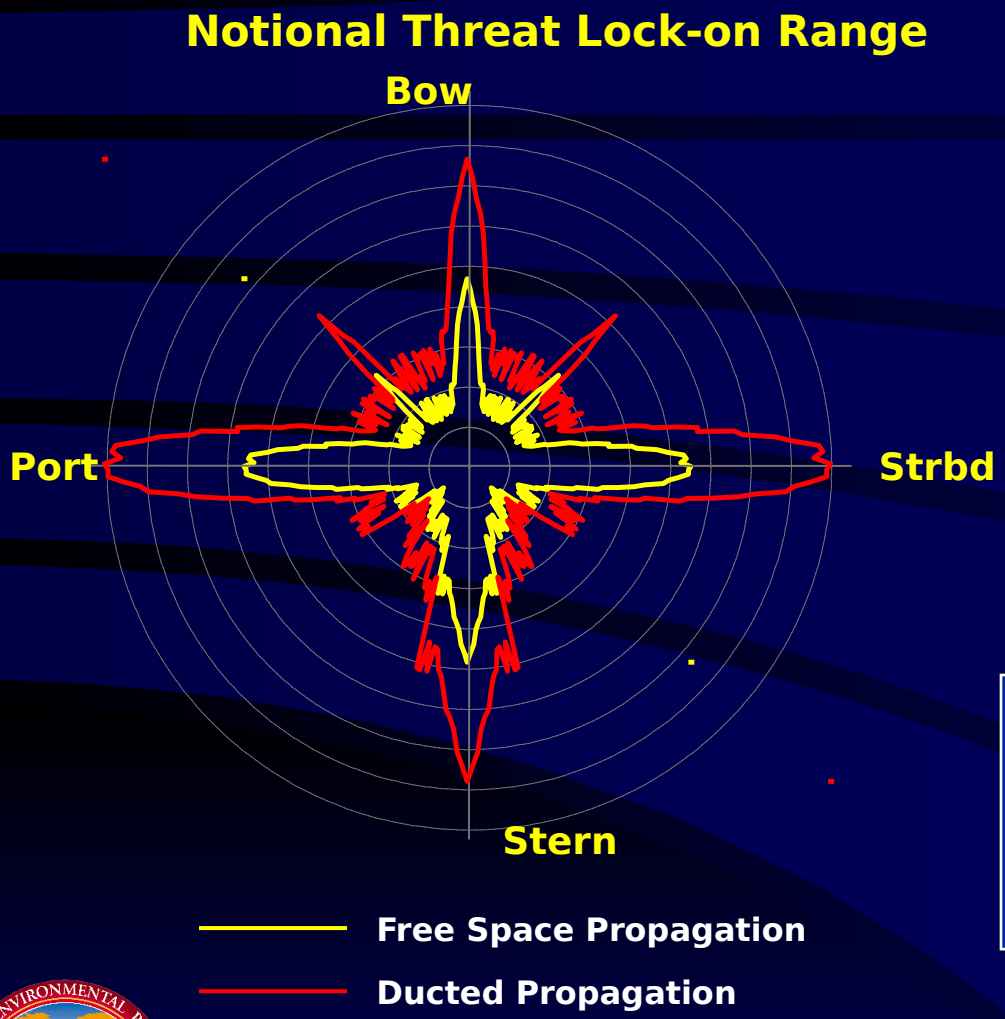
Weather



Aerosol



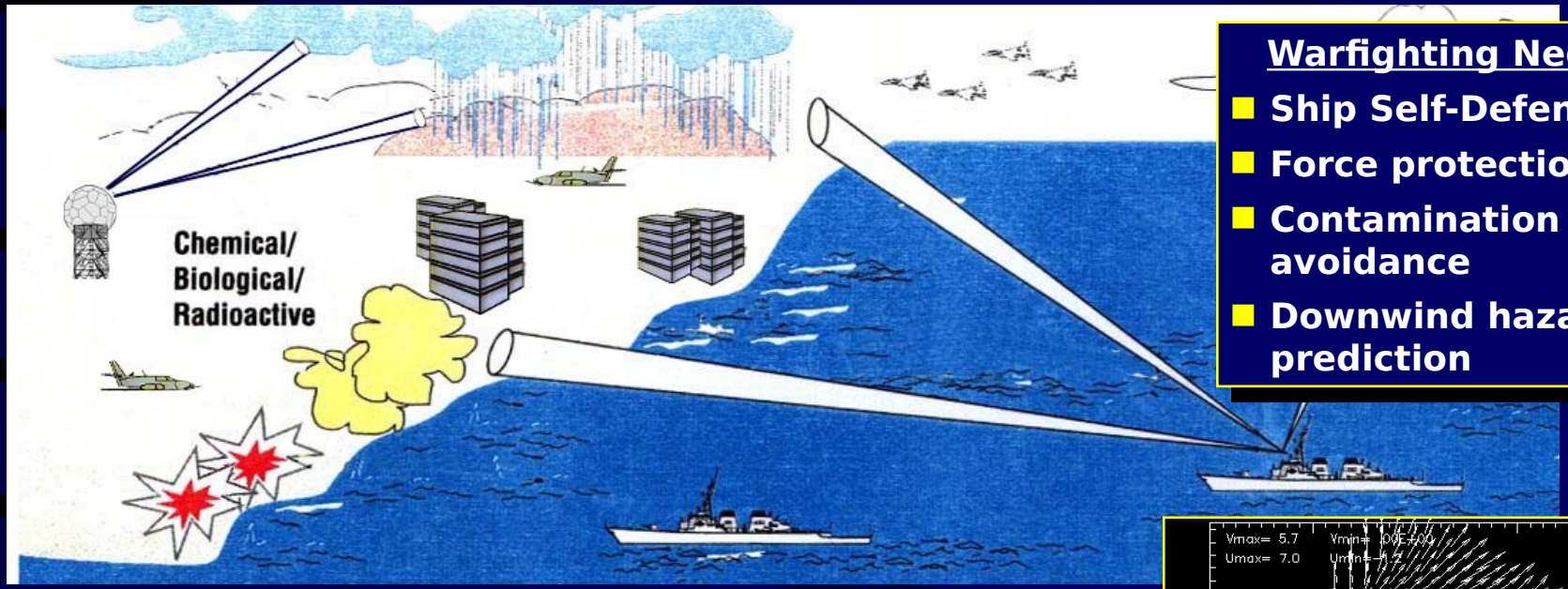
Tactical Situation Management Concept



- Ship Signature influences:
  - Detection, Targeting & Lock
  - Hard kill Effectiveness
  - Soft-Kill Effectiveness
  - Chance to Shoot the Archer
  - Engagement Timeline

Integrated Management of Signature, Hard-Kill, & Soft-Kill May Improve Overall Effectiveness Against Stressing Threats

TEP Support for Chem/Bio Defense

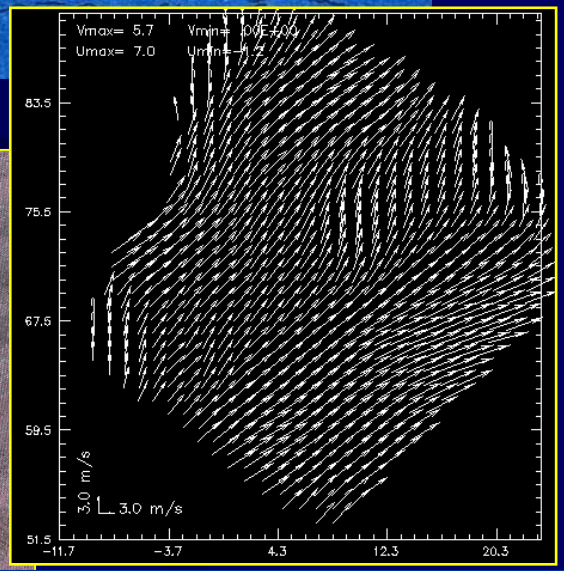


Warfighting Needs

- Ship Self-Defense
- Force protection
- Contamination avoidance
- Downwind hazard prediction

- Local, Up-To-The-Minute Winds & Storms
- 3-D Wind Measurements Support Chem/Bio Dispersion Models and Warfighting Ops
- Data Distributed to Joint Forces and Regional METOC Centers via SIPRNET
- Advanced warning for battle groups, littoral forces, SPODs and civilian areas

Storm/Cloud Motion Prediction



Dual-Doppler Wind Fields

AEGIS Environmental Assessment Tool

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Phased Implementation
(LM Perspective)

	Phase 0/1 Rapid Deployment TDA	Phase 2 Thru-the-Sensor Assessment Tool	Phase 3 Integrated Assessment Tool
Configuration	•MORIAH •SEAWASP-2	Additional Elements •SPY-1/TEP •RFC Evap Duct •Tactical Assessment Tool •NOWCAST	Additional Elements •RFC Surface Duct •Radar Feedback Loop
Capabilities	•2-D Ducts •P(D) and Depth of FIre •Radar Doctrine TDA	Additional Capabilities •3-D Evap Ducts •Radar Waveform TDA •Weapons Assessment Tool •Doppler Winds Aloft •Storm Cells •Chaff Cloud Mapping •Support for Helo, UAV Ops •SATCOM Link Performance •Support Carrier Air, Strike Ops •Chem/Bio Support	Additional Capabilities •3-D Surface Ducts •Auto Radar Optimization •Integrated Environmental Resource Planning Tool •Low/Slow Target Recognition •Jammer Discrimination •Area Defense TDA

Legend: White = Demonstrated Capability; Yellow = Requires Additional R&D

Forward Plan

- Leverage Successful At-Sea Tech Demo of TEP and RFC (Evap Duct)
- Develop Integrated Environmental Assessment System with TEP/RFC, SEAWASP
  - **Radar Optimization Tool**
  - **MET Products for Air Ops, Strike Ops**
  - **Area Defense Planning and Assessment Tool**
- Incorporate Chem/Bio Support with Dispersion Models, Validate Detection Capability
- Develop Real-Time Data Link to NOWCAST System

- Notional Timeline (Pending Funding Decisions)
  - **Rapid Deployment SEAWASP TDA 6-9 Months**
  - **Thru-the-Sensor Environment Assmt Tool (TEP/RFC) EDM 18 Months**
  - **Integrated Environmental Assessment Tool 3-4 Years**